

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-221839

(43)Date of publication of application : 17.08.1999

(51)Int.Cl.

B29C 45/16

B29D 11/00

G02B 3/00

(21)Application number : 10-027097

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(22)Date of filing : 09.02.1998

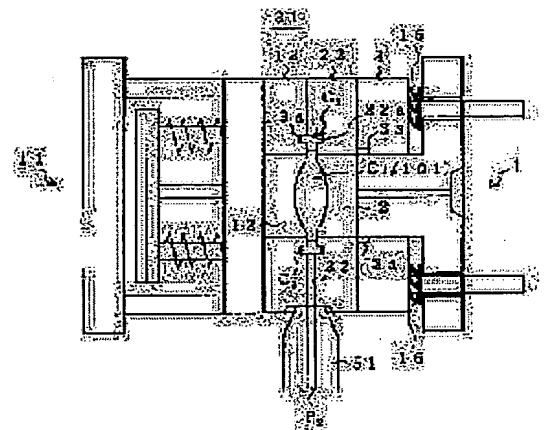
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(54) TWO-COLOR MOLDING METHOD AND MOLDING TOOL OF OPTICAL COMPONENT

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a two-color molding tool wherein a sufficient dwell time can be secured in a primary molding process, and the whole molding time can be shortened.

SOLUTION: In a primary molding tool, an optical element part molding cavity C1 is formed with a fixed side nest piece 2, a fixed side movable plate 3, a movable side nest piece 12, and a movable side template 13, and an outer peripheral part of the cavity is protruded to an outer peripheral side of the nest pieces 2, 12. A secondary molding tool 31 is constituted by fitting freely detachably to a fixed side molding plate 22 to be bonded to the movable side template 13 in place of the fixed side movable plate 3 in the primary molding tool, and a cavity for molding a support part C1 is formed by being communicated to an outer peripheral side of the optical element part molding cavity C1 and being communicated thereto. When the fixed side molding plate 22 is fitted, the fixed side movable plate 3 is retreated without separating the fixing side nested piece 2 from the movable side nested piece 12, and the fixed side molding plate 22 is installed in an opening between the fixed side movable plate 3 and the movable plate template 13.



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[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

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CLAIMS

[Claim(s)]

[Claim 1] By being injected and filled up with the 1st melting resin at the cavity of the primary molding die constituted by a cover half and the ejector half, fabricating the 1st order, and making the configuration member of a cover half, or the configuration member of an ejector half estrange from a partner's mold in the dwelling of these primary mold goods these some primary mold goods are exposed from a primary molding die -- making -- said alienation, while constituting a secondary molding die by equipping space with the metal mold configuration member for secondary shaping The 2 color shaping approach characterized by being injected and filled up with the 2nd melting resin at this cavity after making the outcrop of said primary mold goods face the cavity of this metal mold.

[Claim 2] The cover half which has a fixed side movable plate, and the ejector half which has a movable retainer plate, Come to have a fixed side movable plate and the fixed side shaping plate which can be freely detached and attached between movable retainer plates. The primary molding die in which it is the metal mold for fabricating two colors of optical components which have the optical element section and the supporter which supports this, and an optical element section molding cavity is formed of junction to a fixed side movable plate and a movable retainer plate, By inserting a fixed side shaping plate between a fixed side movable plate and a movable retainer plate, and joining a fixed side shaping plate to a movable retainer plate by migration of a fixed side movable plate The molding die of the optical component to which this cavity is characterized by changing and constituting an optical element section molding cavity and a secondary molding die open for free passage at the same time a supporter molding cavity is formed.

[Claim 3] In the metal mold for fabricating two colors of optical components equipped with the optical element section and the supporter which supports this The cover half equipped with the fixed side nest and the fixed side movable plate which can slide on the peripheral face freely, The ejector half equipped with the movable retainer plate which has a movable side nest constitutes a primary molding die. In this primary molding die To the periphery part of the fixed side nest in a fixed side movable plate, suitably the 1st crevice of a configuration Each is suitably formed in the periphery part of the movable side nest in a movable retainer plate for the 2nd crevice of a configuration. By junction to a fixed side movable plate and a movable retainer plate While constituting so that an optical element section molding cavity may be formed of the nest and the 1st crevice of said pair which counter mutually The impregnation passage of primary molding resin is formed in said fixed side nest. The fixed side shaping plate in which the 3rd crevice for fabricating said supporter was formed It inserts in the clearance formed by sliding of said fixed side movable plate to said fixed side nest free [insertion and detachment], and the peripheral face of said fixed side nest is received. That sliding is free Nothing, By joining said fixed side shaping plate to a movable retainer plate by sliding of said fixed side movable plate A supporter molding cavity is formed in said the 2nd crevice and 3rd crevice. and That the impregnation passage of the secondary molding resin which is open for free passage at said supporter molding cavity to the junction interface of said movable retainer plate and said fixed side shaping plate at the same time this cavity is open for free passage to said optical element section molding cavity is formed, and a secondary molding die is constituted The molding die of the optical component by which it is characterized.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the structure of the 2 color (injection) shaping approach and 2 color molding die of an optical component.

[0002]

[Description of the Prior Art] The 2 color shaping approach is widely adopted as shaping of the former, for example, an optical component. After that reason can produce the optical element section and its supporter comparatively really easily as an object and produces the optical element section and a supporter separately for this reason, it is because there is an advantage to which the complicated process of attaching these becomes unnecessary.

[0003] When producing the above-mentioned optical component by the 2 color shaping approach, generally, it is injected and filled up with primary molding resin at a primary molding die, and the optical element section (or supporter) is fabricated, and joining and the approach of making it unify are taken in these optical element section and a supporter at the same time it fabricates said supporter (or optical element section) by being injected and filled up with secondary molding resin that a secondary molding die is subsequently constituted by proper actuation.

[0004] By the way, about the forming technique of an optical component, the metal mold structure and the shaping approach for fabricating the structure of an optical component and this, for example to (1) JP,9-105871,A and (2) JP,9-108174,A are proposed. A tip lens is fabricated by the shaping approach currently indicated above (1) by being optically injected and filled up with transparent PMMA resin (methacrylic resin) to the primary cavity formed by male metal mold and primary female metal mold (primary shaping). Subsequently, joining and the unification of a tip lens and a supporter are done at the same time it forms a secondary cavity, it injects and fills up the black PMMA resin to this with male metal mold, secondary female metal mold, and said tip lens and it fabricates a supporter by changing to primary female metal mold and setting secondary female metal mold (secondary shaping).

[0005] In the shaping approach indicated above (2), it is injected and filled up with the black PMMA resin to the primary cavity formed by male metal mold and primary female metal mold contrary to the above (1), and a supporter is fabricated (primary shaping). Subsequently, a secondary cavity is formed with male metal mold, secondary female metal mold, and a supporter by changing to primary female metal mold and setting secondary female metal mold, and joining and the unification of a tip lens and a supporter are done at the same time it fabricates a tip lens by being optically injected and filled up with transparent PMMA at this (secondary shaping).

[0006]

[Problem(s) to be Solved by the Invention] However, if it is in 2 color molding die indicated by the official report of the above (1), in case it changes to primary female metal mold and secondary female metal mold is set, it has the structure of separating the part which touched the light transmission side of a tip lens among the shaping sides of primary female metal mold until now with this tip lens. For this reason, high pressure and the dwelling process of long duration were required of primary shaping.

[0007] Since similarly it had the structure of separating the part which touched the supporter among the shaping sides of primary female metal mold until now with this supporter, in 2 color molding die indicated by the official report of the above (2) in case it changes to primary female metal mold and secondary female metal mold is set, similarly in the primary cavity, the dwelling of high pressure and long duration was needed. Thus, in the conventional 2 color molding die, since shaping took time amount, there was a problem that it was difficult to manufacture 2 color mold goods of high quality cheaply.

[0008] This invention was made in view of the above-mentioned trouble of the conventional technique, and the 1st purpose is in offering the 2 color shaping approach in which the secondary cavity was formed, without

opening a primary cavity substantially after primary shaping (i.e., without it separating most primary molding dice (shaping side) from primary mold goods).

[0009] The 2nd purpose of this invention is offering the suitable metal mold structure for optical component shaping enforcing the above-mentioned 2 color shaping approach.

[0010]

[Means for Solving the Problem] The 2 color shaping approach concerning this invention is injected and filled up with the 1st melting resin at the cavity of the primary molding die constituted by a cover half and the ejector half, and fabricates it the 1st order. By making the configuration member of a cover half, or the configuration member of an ejector half estrange from a partner's mold in the dwelling of these primary mold goods these some primary mold goods are exposed from a primary molding die -- making -- said alienation, while constituting a secondary molding die by equipping space with the metal mold configuration member for secondary shaping. After making the outcrop of said primary mold goods face the cavity of this metal mold, it is characterized by being injected and filled up with the 2nd melting resin at this cavity.

[0011] Moreover, the molding die of the optical component concerning this invention The cover half 1 which has the fixed side movable plate 3, and the ejector half 11 which has a movable retainer plate 13, Come to have the fixed side movable plate 3 and the fixed side shaping plate 22 which can be freely detached and attached between movable retainer plates 13. It is the metal mold for fabricating two colors of optical components 101 which have the optical element section 102 and the supporter 103 which supports this. It is the optical element section molding cavity C1 by junction to the fixed side movable plate 3 and a movable retainer plate 13. The primary molding die 21 formed, By inserting the fixed side shaping plate 22 between the fixed side movable plate 3 and a movable retainer plate 13, and joining the fixed side shaping plate 22 to a movable retainer plate 13 by migration of the fixed side movable plate 3 Supporter molding cavity C2 It is this cavity C2 at the same time it is formed. Optical element section molding cavity C1 It is characterized by changing and constituting the secondary molding die 31 open for free passage.

[0012] Furthermore, the molding die of the optical component concerning this invention For example, as shown in drawing 1 - drawing 4, the optical component 101 equipped with the optical element section 102 and the supporter 103 which supports this is set to the metal mold for fabricating two colors. The cover half 1 equipped with the fixed side nest 2 and the fixed side movable plate 3 which can slide on the peripheral face freely, The ejector half 11 equipped with the movable retainer plate 13 which has the movable side nest 12 constitutes the primary molding die 21. In this primary molding die 21 To the periphery part of the fixed side nest 2 in the fixed side movable plate 3, suitably 1st crevice 3a of a configuration Each is suitably formed in the periphery part of the movable side nest 12 in a movable retainer plate 13 for 2nd crevice 13a of a configuration. By junction to the fixed side movable plate 3 and a movable retainer plate 13 It is the optical element section molding cavity C1 by the nests 2 and 12 of said pair and 1st crevice 3a which counter mutually. While constituting so that it may be formed The fixed side shaping plate 22 which formed the impregnation passage of primary molding resin in the fixed side nest 2, and formed 3rd crevice 22a for fabricating a supporter 103 It inserts in the clearance formed by sliding of the fixed side movable plate 3 to the fixed side nest 2 free [insertion and detachment], and the peripheral face of the fixed side nest 2 is received. That sliding is free Nothing, By joining the fixed side shaping plate 22 to a movable retainer plate 13 by sliding of the fixed side movable plate 3 It is the supporter molding cavity C2 at 2nd crevice 13a and 3rd crevice 22a. It is formed. and This cavity C2 Optical element section molding cavity C1 It is the supporter molding cavity C2 to the junction interface of a movable retainer plate 13 and the fixed side shaping plate 22 at the same time it is open for free passage. That the impregnation passage 32 of secondary molding resin open for free passage is formed, and the secondary molding die 31 is constituted It considers as the description.

[0013]

[Example] Hereafter, the example of this invention is explained to a detail based on a drawing. Drawing 1 is the outline sectional view showing the structure of 2 color molding die (primary molding die), and the primary forming cycle of the optical component by this. The outline sectional view and drawing 3 which show the 1st step of a preparation process in case drawing 2 changes the metal mold of drawing 1 to a secondary molding die are the outline sectional view showing the 2nd step of the preparation process in the case of changing the metal mold of drawing 1 to a secondary molding die. Drawing 4 is the outline sectional view showing the structure of a secondary molding die, and the secondary forming cycle of the optical component by this. The A-A line sectional view of drawing 5 and drawing 7 of the front view and drawing 6 which show the optical component by which drawing 5 is fabricated by 2 color molding die of drawing 1 - drawing 4 are the top views of drawing 5.

[0014] The optical component 101 shown in drawing 5 - drawing 7 is equipped with the optical element section (convex lens) 102 which is the primary mold goods by 2 color molding die shown in drawing 1 - drawing 4 and in-a-circle lobe which surrounds this 102a, and the supporter 103 of the cross-section the mold of T characters

which is the secondary mold goods which countered mutually and were prepared in said lobe 102a. The above-mentioned primary mold goods consist of PMMA resin, and the above-mentioned secondary mold goods consist of ABS plastics. 104 is the welding of the optical element section 102 and a supporter 103. The optical instrument which is not illustrated is equipped with an optical component 101 free [attachment and detachment] through a supporter 103.

[0015] In this case, while forming a rotation mechanical component and a power transmission device with the gearing which operates by this in an optical instrument, a gearing (not shown) can be attached in the top-face core of the upper supporter 103 in drawing 5, and it can also constitute from meshing this gearing and the gearing of the above-mentioned power transmission device so that this optical component 101 may be rotated around the center line I of drawing 5. Moreover, if a supporter 103 is fabricated with the ABS plastics of the type excellent in sliding nature (self-lubricity), an optical component 101 can be used as a sliding lens.

[0016] The primary molding die 21 is constituted as shown in drawing 1. That is, the cover half 1 which equipped the core with the fixed side nest 2, and was equipped with the fixed side movable plate 3 which can slide on the peripheral face of this fixed side nest 2 freely, and the ejector half 11 which equipped the core with the movable retainer plate 13 which has the movable side nest 12 in one constitute the primary molding die 21. In this primary molding die 21, each is formed in the periphery part of the fixed side nest 2 in the fixed side movable plate 3 for 2nd crevice 13a to the periphery part of the movable side nest [in / for 1st crevice 3a / a movable retainer plate 13] 12 (see drawing 2). A smooth flat side is made to these planes of composition so that the fixed side movable plate 3 and a movable retainer plate 13 may carry out adhesion junction. In addition, since it is for fabricating the optical element section 102, the fixed side nest 2 and the movable side nest 12 need to finish these front faces with high precision.

[0017] It is the optical element section molding cavity C1 by closing this in this primary molding die 21, as shown in drawing 1. It constitutes so that it may be formed. That is, it considers as the structure where the cavity for optical element section 102 and the cavity for the inner circumference sections of the above-mentioned in-a-circle lobe 102a are formed of the nests 2 and 3 of a pair, and the cavity for the periphery sections of in-a-circle lobe 102a is formed of 1st crevice 3a of the above-mentioned fixed side movable plate 3, and the above-mentioned smooth flat side of a movable retainer plate 13.

[0018] For an ejector plate and 6, as for a support pillar and 8, in drawing 1, an ejector pin and 7 are [4 / a movable bottom plate and 5 / a movable side supporting plate and 9] fixed side movable plate guide pins. 10 is a fixed bottom place and the above-mentioned nest 2 has fixed to this at one. 14 is the impregnation passage of primary molding resin (P1-MMA resin), and this impregnation passage stands in a row in the impregnation passage (not shown) formed in the nest 2. 15 is a return pin and 16 and 17 are compression springs.

[0019] On the other hand, as shown in drawing 4, the secondary molding die 31 is changed to the fixed side nest 2, the fixed side movable plate 3, and the fixed side movable plate 3 in the combination (primary molding die 21) which consists of a movable retainer plate 13 with movable side nest 12, and is constituted by equipping with the fixed side shaping plate 22.

[0020] As shown in drawing 4, when a configuration constitutes this fixed side shaping plate 22 of each other from two metal mold members symmetrical with a field and the secondary molding die 31 is closed by these Supporter molding cavity C2 It is formed and is this cavity C2 to this and coincidence. Said optical element section molding cavity C1 Are open for free passage. And it is the above-mentioned supporter molding cavity C2 to the junction interface of a movable retainer plate 13 and this fixed side shaping plate 22. The impregnation passage 32 of secondary molding resin (P2 : ABS plastics) open for free passage is formed. This impregnation passage 32 shall be formed of junction to slot 32a (see drawing 3) formed in the fixed side shaping plate 22, and the above-mentioned smooth flat side of a movable retainer plate 13.

[0021] That is, as shown in drawing 3, 3rd crevice 22a for fabricating the right half part of the up-and-down supporter 103 shown in drawing 5 to one side of these metal mold members is formed in crevice 13a of the above 2nd, and the location which counters, and, similarly 3rd crevice 22a for fabricating the left half part of the up-and-down supporter 103 to the metal mold member of another side is formed in 2nd crevice 13a and the location which counters. Moreover, these metal mold members make attachment and detachment free to the fixed side nest 2 by making it counter mutually and making longitudinal slide movement carry out in the direction perpendicular to the space of drawing 4. It is the supporter molding cavity C2 so that clearly from drawing 4 and the above-mentioned explanation. It is formed of crevice 13a of the above 2nd, and 3rd crevice 22a of the above-mentioned metal mold member.

[0022] As mentioned above, the description is in the point of having made these cavities opening for free passage at the same time it forms the cavity for fabricating the optical element section 102 and the inner circumference section of the above-mentioned in-a-circle lobe 102a in the above-mentioned primary shaping metal mold 21 by the nests 2 and 12 of the pair which counters mutually and forms the cavity for fabricating the

periphery section of in-a-circle lobe 102a with the fixed side movable plate 3 and a movable retainer plate 13 further.

[0023] Moreover, in the secondary molding die 31, holding nests 2 and 12 in the condition of drawing 1 Carry out sliding retreat of the fixed side movable plate 3 to a nest 2, and the fixed side shaping plate 22 is inserted in the annular clearance S (see drawing 2) formed between a movable retainer plate 13 and the fixed side movable plate 3 (see drawing 3). Supporter molding cavity C2 which is open for free passage by this with the periphery section molding cavity of the above-mentioned in-a-circle lobe 102a The description is to have made it formed.

[0024] Below, the shaping approach of the optical component 101 of drawing 5 by this 2 color molding die is explained.

(1) As shown in preparation drawing 1 of the primary forming cycle ** primary molding die 21, while advancing a movable retainer plate 13 in a forward limit location, constitute the primary molding die 21 shown in drawing 1 by advancing the fixed side movable plate 3 according to the elastic force of a compression spring 16, and joining the smooth flat side of this movable plate 3, and the smooth flat side of a movable retainer plate 13.

[0025] ** Advance an injection unit 41 with a conventional method, make the point contact the back end side of a fixed bottom place 10, as shown in operation drawing 1 of a primary forming cycle, and it is primary molding resin P1. The impregnation passage 14 is minded and it is the optical element section molding cavity C1. It is injected and filled up. after this restoration -- dwelling -- subsequently die cooling is performed. The secondary molding die 31 is constituted as follows among dwelling.

[0026] (2) As shown in preparation drawing 2 of the secondary forming cycle ** secondary molding die 31, with actuators, such as an oil hydraulic cylinder, resist the elastic force of a compression spring 16, retreat the fixed side movable plate 3, and form the above-mentioned annular clearance S. Subsequently, as shown in drawing 3, after inserting the fixed side shaping plate 22 in this annular clearance S, the secondary molding die 31 which is made to join the smooth flat side of a movable retainer plate 13, and shows the smooth flat side at fixed side shaping plate 22 tip to drawing 4 by advance of the fixed side movable plate 3 by the compression spring 16 is constituted.

[0027] ** Advance an injection unit 51 with a conventional method, make the point contact the joint of a movable retainer plate 13 and the fixed side shaping plate 22, as shown in operation drawing 4 of a secondary forming cycle, and it is secondary molding resin P2. The impregnation passage 32 is minded and it is the supporter molding cavity C2. It is injected and filled up. after this restoration -- dwelling -- subsequently die cooling is performed. The inner skin of a supporter 103 welds [in-a-circle lobe 102] like the above-mentioned packer (welding 104 of drawing 6).

[0028] (3) Retreat the drawing fixed side movable plate 3 of mold goods, remove the fixed side shaping plate 22, and return to the condition of drawing 2. Subsequently, after fully separating a nest 12 from a nest 2 by retreating an ejector half 11 and a movable retainer plate 13 in one, the optical component 101 shown in drawing 4 and drawing 6 is projected by the ejector pin 6.

[0029] Thus, unlike the conventional optical component molding die, in this 2 color molding die, the dead work of a secondary forming cycle can be performed into the dwelling of a primary forming cycle. That is, in being able to shift to a secondary forming cycle as it is, without separating the nests 2 and 12 for optical element section shaping in a primary molding die (mold aperture), there is an advantage that metal mold structure can be made easy. Therefore, taking sufficient dwelling time in the primary forming cycle for fabricating the body of a lens, shaping which shortened the whole cycle time compared with the case of the conventional metal mold is attained, and, for this reason, the optical component equipped with the lens excellent in the optical property can be manufactured more cheaply.

[0030] in addition, the above-mentioned example -- an optical component -- public funds -- although a mold is started, this invention is widely applicable to the 2 color shaping approach or 2 color molding die in the case of really fabricating the primary mold goods which need to perform not only this but highly precise shaping, and the attached sections, such as a supporter which is secondary mold goods, -- it comes out.

[0031]

[Effect of the Invention] In being able to shift to a secondary forming cycle in the above explanation according to the 2 color shaping approach or 2 color molding die concerning this invention, without being able to perform the dead work of a secondary forming cycle into the dwelling of a primary forming cycle, and performing the mold aperture of the die for the bodies of primary mold goods in a primary molding die so that clearly, metal mold structure can be made easy. For this reason, shaping which shortened the whole cycle time compared with the conventional technique is attained, securing sufficient dwelling time over the body of primary mold goods in a primary forming cycle. Therefore, according to this invention, it is effective in the ability to manufacture more cheaply the optical component equipped with the lens excellent in the optical property.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the outline sectional view showing the structure of 2 color molding die (primary molding die) of this invention, and the primary forming cycle of the optical component by this.

[Drawing 2] It is the outline sectional view showing the 1st step of the preparation process in the case of changing the metal mold of drawing 1 to a secondary molding die.

[Drawing 3] It is the outline sectional view showing the 2nd step of the preparation process in the case of changing the metal mold of drawing 1 to a secondary molding die.

[Drawing 4] It is the outline sectional view showing the structure of a secondary molding die, and the secondary forming cycle of the optical component by this.

[Drawing 5] It is the front view showing the optical component fabricated by 2 color molding die of drawing 1 - drawing 4.

[Drawing 6] It is the A-A line sectional view of drawing 5.

[Drawing 7] It is the top view of drawing 5.

[Description of Notations]

1 [-- The 1st crevice,] -- A cover half, 2 -- A fixed side nest, 3 -- A fixed side movable plate, 3a 4 [-- Support pillar,] -- A movable bottom plate, 5 -- An ejector plate, 6 -- An ejector pin, 7 8 -- A movable side supporting plate, 9 -- A fixed side movable plate guide pin, 10 -- Fixed bottom place, 11 [-- The 2nd crevice,] -- An ejector half, 12 -- A movable side nest, 13 -- A movable retainer plate, 13a The impregnation passage of 14--primary molding resin, 15 -- 16 A return pin, 17 -- Compression spring, A 21--primary molding die, 22 -- A fixed side shaping plate, 22a -- The 3rd crevice, A 31--secondary molding die, the impregnation passage of 32--secondary molding resin, 32a -- Slot, 41 51 -- An injection unit, 101 -- An optical component, 102 -- Optical element section (convex lens), 102a [-- An optical element section molding cavity and C2 -- A supporter molding cavity and P1 -- Primary molding resin and P2 -- secondary molding resin, S -- Annular clearance.] -- A lobe in a circle, 103 -- A supporter, 104 -- A welding and C1

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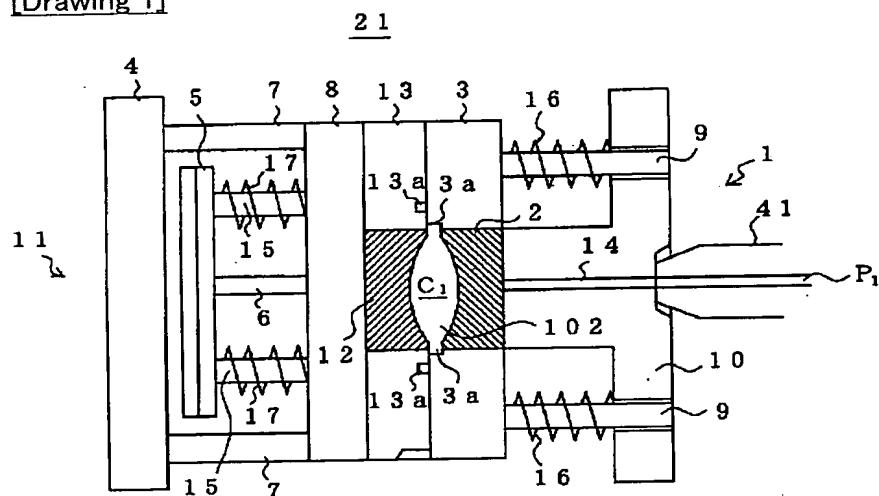
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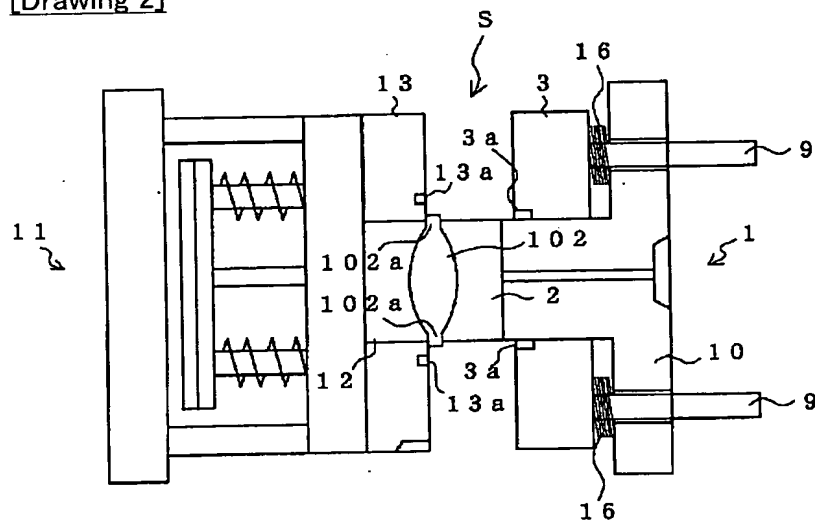
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DRAWINGS

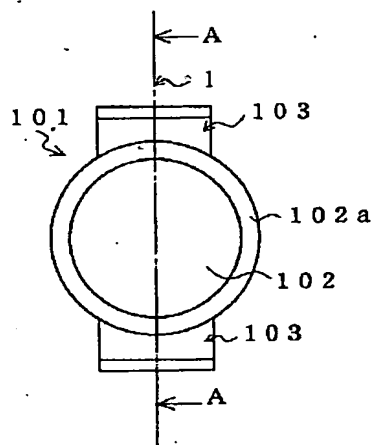
[Drawing 1]



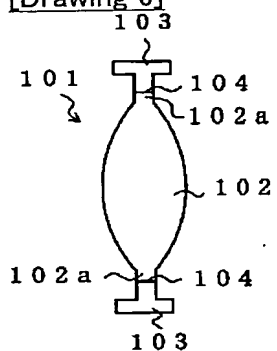
[Drawing 2]



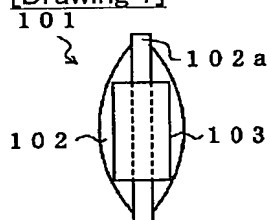
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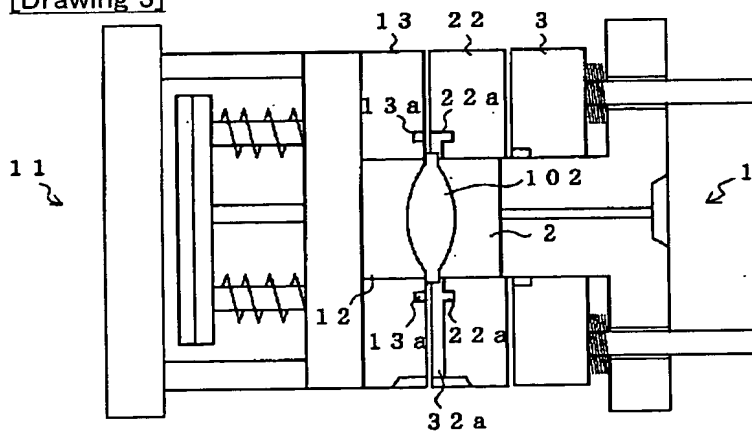
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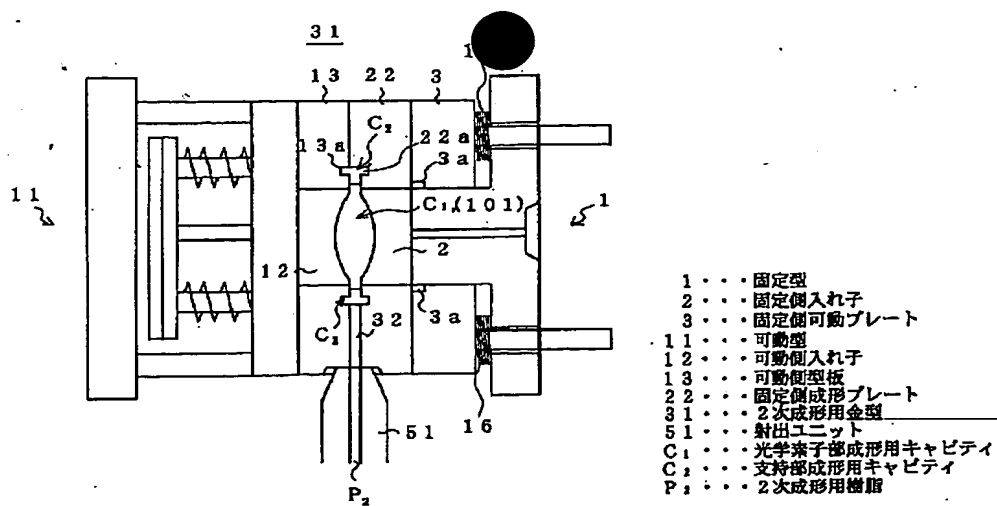
[Drawing 7]



[Drawing 3]



[Drawing 4]



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